CONTROL OF SALTING SCHEDULE AND ITS EFFECT ON THE QUALITY AND STORAGE LIFE OF CURED FISH

by

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ABSTRACT

Results of investigation on the effect of salt penetration on the quality and storage stability of salted-dried croaker (Jonius sp.) and salted-dried lizard fish (Saurida sp.) are reported. Dressed fish salted for less than 24 h at a fish/salt ratio 4:1 and dried to 35% moisture did not develop the characteristic cured quality and were understabilized with less than 45 days storage at ambient conditions. With higher durations of salting the dried product became brittle and fibrous and became prone to early onset of rancidity. Salt-induced dehydration of the fish was significant at 12 to 24 h of salting and thereafter it almost levelled off. The study thus reveals that intermediate moisture foods of reasonable storage stabillity could be prepared from croaker and lizard fish by salting at a salt/fish ratio 1:4 for 24 h followed by drying to 35% moisture level. The optimized method reduces processing costs and improves product quality.

INTRODUCTION

In India intermediate moisture foods are still in great demand because of the low production costs and consumer appeal. Storage stabililty of the cured fish is due to the restricted availability of water for microbial growth and biochemical reactions, brought about by drying and facilitated greatly by the addition of sodium chloride which lowers the water activity (aw) to a safer level. It is necessary to optimize the salting process to stabilize the fish for sufficiently long storage life. Salting of fish is thus a process which aims at reaching the saline equilibrium between the muscle and the surrounding salt solution in a specific time. In commercial practice fish are generally salted for days depending upon the weather and most often the market demand (George Joseph *et al.*, 1983, Muraleedharan *et al.*, 1989). This practice makes the product understabilized resulting in strong consumer resistance. The present work aims at optimizing the salting of two underutilized fish viz. lizard fish and croaker. The effect of different durations of salting on the quality of the dried product are presented and discussed.

MATERIALS AND METHODS

Lizard fish (Saurida sp. - average length 23 cm, average weight 145 g) and croaker (Johnius sp. - average length 25 cm, average weight 218 g) were collected from the trawl catches on board a deep sea research vessel. The fish were immediately frozen and stored at –20°C. and brought to the shore laboratory when the vessel touched port (5 days). The fish were thawed in running water, gutted and washed free of slime and blood. Salting was done with curing salt (IS:594 1962) at a ratio 1:4 (salt:fish w/w). The salted fish were kept in PVC containers with lids. Sampling of the salted fish was done at 3, 6, 12, 18, 24, 36 and 48 h for analysis of different quality parameters. Drying of the salted samples was done by spreading on nylon mesh trays and exposing to the sun till the moisture reduced to about 35%. The cured fish were packed in 25x18 cm pouches of 50u polyester polythene, sealed and stored at ambient conditions. (temperature 26-31*C.RH 80-90%). Moisture, salt and protein were analysed according to AOAC (1990) methods. Fat was determined by extraction with petroleum ether using a soxtlet analyser. TVN was estimated by the microdiffusion method of Conway (1962). Reconstitution properties were assessed by the method of Sen *et al.* (1961). Organoleptic evaluation of the desalted (cold water, 1h) and cooked (boiling water, 10 min) samples was conducted by a panel of 6 members.

RESULTS AND DISCUSSION

Proximate composition of the fish were comparable. Croaker: of 71% moisture, protein 19.72 % and 4.2% fat and lizard fish: of 73% moisture, protein 23.39% and 3.9% fat. Thus the body constituents of the fish had similar and comparable influence on the penetration of salt and moisture removal when the dressed fish were kept salted. Fig. 1 and 1A show that salt uptake reached its maximum after 24 h salting with little subsequent increase, while moisture loss increased rapidly to 24 h salting and almost ceased thereafter indicating the formation of a saline equilibrium. Drying of fish salted for different periods took varying times for dehydration (data not given) to reach a moisture level of about 35%, which is the standard specified for salted- dried fish by the Bureau of Indian Standards (IS :8836,1985). Fish with low salt content took more time to dry. However, salting beyond 24 h did not significantly reduce the drying period. Fish salted for longer than 24 h gave dried products of brittle surface with visible salt crystals. Higher salt content might have induced protein denaturation causing decreased water retention ability (Poernomo *et al.*,1992). This leads to rapid moisture diffusion to the fish surface during the early stages of drying facilitating salt crystal formation, and consequent brittleness. Reconstitution ability of the dried fish decreased gradually with increase in salt content (Figs. 2, 2A), indicating again salt-induced protein denaturation and consequent loss of water retention property. Fish salted for longer than 24 h showed a tendency for fragmentation during reconstitution. It appears that the extent of salting can affect disintegration of fish tissues. The salted-dried products were evaluated by a panel for sensory quality. The panel showed preference for fish that was salted for less than 24 h. Fish salted for 48 h obtained the minimum score because of the poor appearance, hard texture and extremely salty taste. The results indicated consumer resistance for high salted product from the point of view of palate and of health considerations. Salting fish for more than 2 days is practised by traditional curers, depending upon the weather and perhaps the market demand. But this practice will affect the appearance and texture of the product in addition to elevating cost of production. From these studies, therefore, it may be concluded that salting time in commercial conditions can be reduced to 24 h for lizard fish and croaker in view of the product quality, and consumer appeal.

Storage characteristics

Under similar conditions of salting (24 hrs.) and drying, cured croaker had 35.5% moisture, 70.12% protein, 4.66% fat and 25.9% sodium chloride while cured lizard fish had 35.15% moisture, 69.85% protein and 26.34% sodium chloride, 3.46% fat expressed on a dry matter basis. Both products showed similar water activities, 0.75 for cured croaker and 0.74 for cured lizard fish. The sample packed in 50 micron polyester/polythene pouches and stored for 60 days at ambient conditions showed variations in colour and odour. Browning and rancid flavours were significant in the high salt (>27%) products, indicating the effect of salt content. However, the stabilizing property of salt against microbial growth was clear from the observation that the TVN formation was greater in the less salted samples (Figs.3, 3A) which became unacceptable within a short span (tables1, 1A). The salt induced hardness was evident in the samples having high concentration of sodium chloride which affected the water retention property of the fibrils causing reduced succulence and harder texture.

The study thus leads to the following findings:

1. Salting for 24 h at a salt /fish ratio 1:4 is optimum to get quality cured products from croaker and lizardfish.
2. Significant dehydration takes place in 12 to 24h of salting and thereafter it almost levels off.
3. Increasing the salt content by prolonged salting of the fish has no added advantage; on the contrary it adversely affects the quality and appearance of the cured product.
4. Fish salted for 24h and dried to 35% moisture could be kept for 3 months at ambient condition without any quality deterioration.

Table 1. Changes in physical characteristics of salted and dried lizard fish during storage.

Sample	Initial	15 days	30days	45days	60days
3 h	Light yellow normal cured odour, soft, firm	Yellow-brown off odour Not acceptable Discarded			
6h	Pale white to yellow soft, firm normal cured odour	Yellow soft, cured odour	Yellow-brown off odour Not acceptable Discarded		
18h	Off white normal cured odour soft, firm	Off white normal cured odour hard	Light yellow Slightly rancid hard	Yellow-brown Rancid, off odour Discarded	--
24h	White, normal cured odour hard	white, fibrous normal cured odour, hard	White-yellow normal cured odour, hard	Yellow slightly rancid hard	Brown, rancid Fungal spots off odour, Discarded
36h	White, normal cured odour soft, firm	white, fibrous hard	white, fibrous rancid, hard	yellow rancid, hard	brown rancid fungus off odour Discarded
48h	white, normal cured odour soft, firm	white, normal cured odour hard	white, fibrous, hard	yellow-brown rancid hard	brown putrid fungus, rancid

Table 1A. Changes in physical characteristics of salted and dried croaker during storage.

Samples	Initial	15 days	30 days	45 days	60 days
3h	Light yellow normal cured odour	yellow-brown off odour Discarded	--	--	--
6h	Light yellow normal cured odour, soft,	yellow slight off odour, soft	yellow fungus, soft off odour Discarded	--	--
18h	White, normal cured odour	dull white normal cured odour, hard	yellow rancid hard	brown off odour fungus Discarded	
24h	white, soft firm, normal odour	dull white normal odour, firm	yellow normal odour, hard	brown S. rancid hard	brown rancid bitter taste fungus
36h	- do -	yellow, normal cured odour	yellow normal odour	yellow rancid fibrous	brown bitter taste off odour
48h	- d0	yellow fibrous hard	yellow S. rancid hard	brown hard rancid	brown rancid off odour fungus

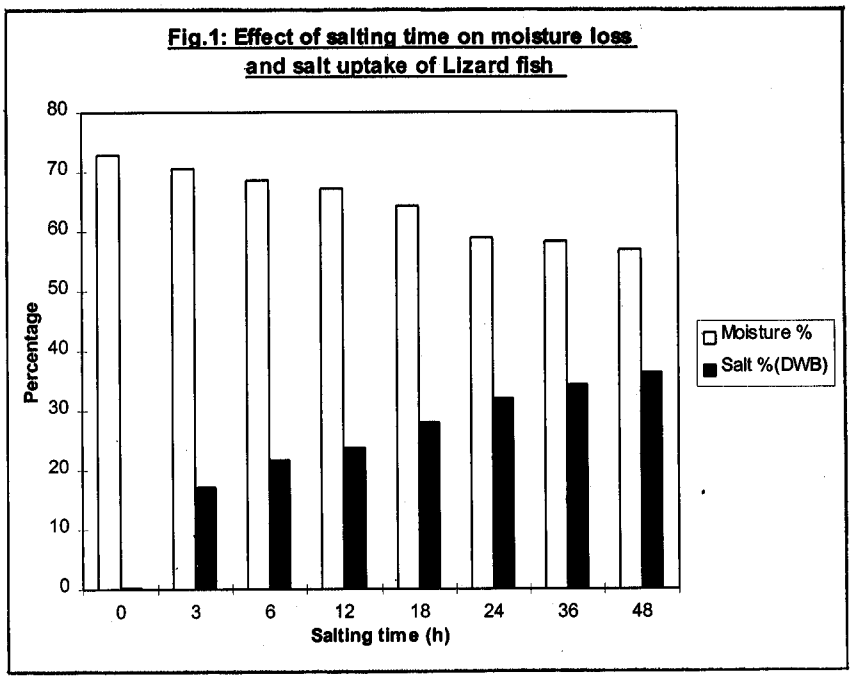
Fig.1: Effect of salting time on moisture loss and salt uptake of Lizard fish
80
70
60
50
40
30
20
10
0
Percentage
0
3
6
12
18
24
36
48
Salting time (h)
Moisture %
Salt %(DWB)

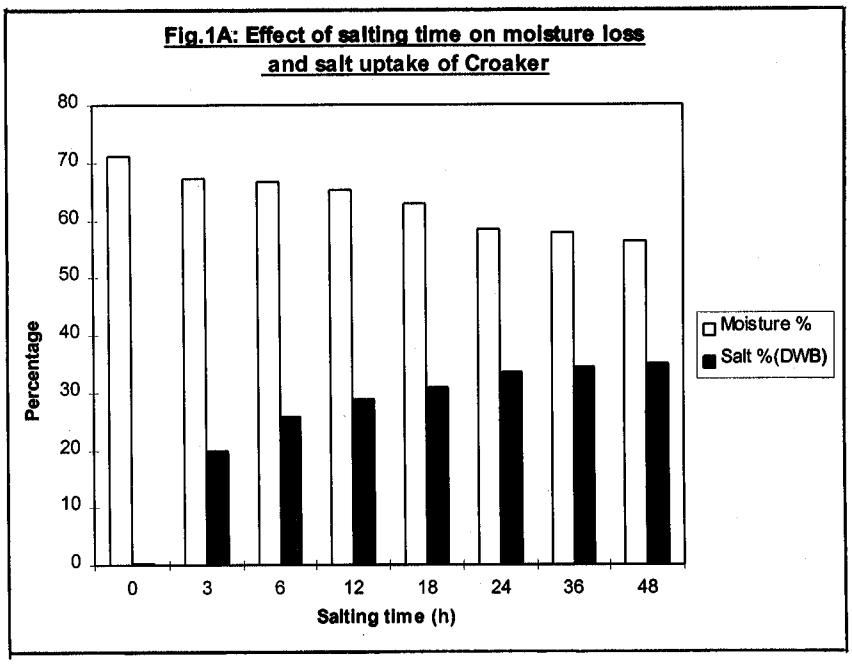
Fig.1A: Effect of salting time on moisture loss and salt uptake of Croaker
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20
10
0
Percentage
0
3
6
12
18
24
36
48
Salting time (h)
Moisture %
Salt %(DWB)

Fig.2: Effect of salting time on reconstitution property of cured Lizard fish during storage

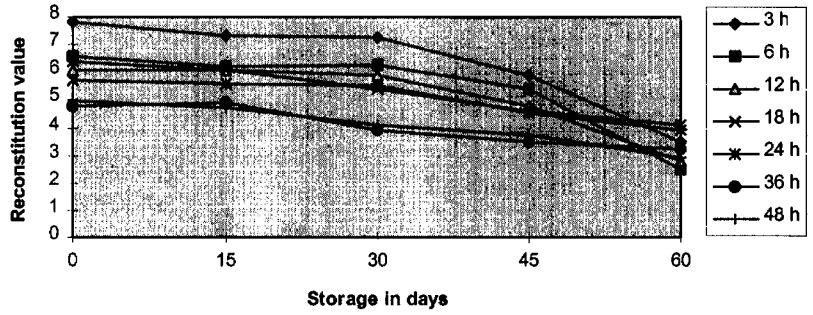


Fig.2A: Effect of salting time on reconstitution property of cured Croaker during storage

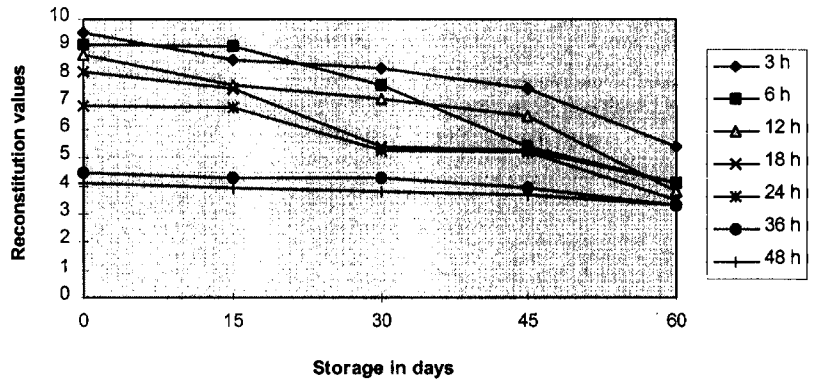


Fig.3: Effect of salting time on TVN formation during storage of cured Lizard fish

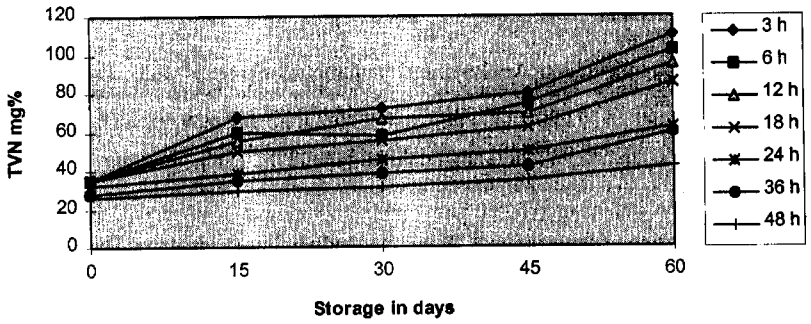
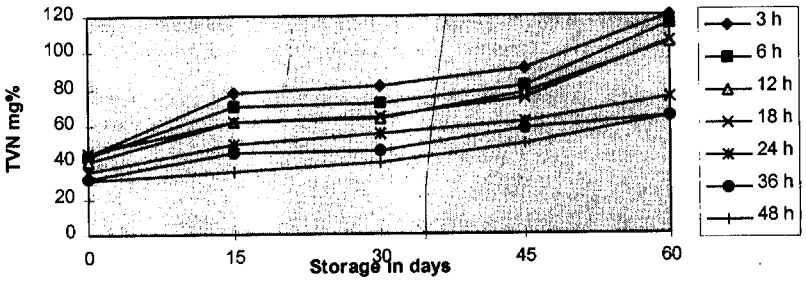


Fig.3A: Effect of salting time on TVN formation during storage of cured Croaker



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